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THESIS

A MULTIVARIATE ANALYSIS OF DEFENSE
EXPENDITURES IN LATIN AMERICA

by

Jack S. Sasser

June 1985

Thesis Advisor: Robert E. Looney

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20. Abstract (cont'd)

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A Multivariate Analysis of Defense Expenditures in Latin America

by

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Submitted in partial fulfillment of the
requirements for the degree of

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from the

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June 1985

ABSTRACT

This study attempts to determine whether developing countries differ with regard to the impact that military and social expenditures have on their overall rates of economic growth. A discriminant analysis of sixty-seven developing countries indicated that based on a relatively small number of discriminating variables developing countries could be categorized as either relatively dynamic or undynamic. Through a multivariate analysis of socio-economic data this study concludes that: 1) military expenditures are positively related to social expenditures and economic growth for the less economically dynamic developing countries and 2) military expenditures are negatively related to social expenditures and economic growth for the more economically dynamic developing countries. The analysis of economic growth and expenditure models also suggest that Latin America is not unique as a region when compared to the other developing countries of the world. The findings of this study are intended to contribute to the formulation of a general theory of defense expenditures and economic growth.

TABLE OF CONTENTS

I. INTRODUCTION 8

II. METHOD OF STUDY 11

    A. DATA AND VARIABLE SELECTION 11

    B. FACTOR ANALYSIS 14

    C. REGRESSION ANALYSIS 14

    D. DISCRIMINANT ANALYSIS 15

    E. TEST OF THE MODEL 16

III. FINDINGS OF THE STUDY 19

    A. RESULTS OF THE FIRST FACTOR ANALYSIS 19

    B. RESULTS OF THE REGRESSION ANALYSIS 21

    C. RESULTS OF THE DISCRIMINANT ANALYSIS 31

    D. RESULTS OF THE TEST OF THE MODEL 40

IV. CONCLUSIONS 53

LIST OF REFERENCES 56

INITIAL DISTRIBUTION LIST 57

LIST OF TABLES

I. DEVELOPING COUNTRIES BY REGION 12

II. DESCRIPTIONS FOR VARIABLES USED IN THE FIRST FACTOR ANALYSIS. 13

III. DESCRIPTIONS FOR VARIABLES USED IN THE SECOND FACTOR ANALYSIS 17

IV. RESULTS OF THE FIRST FACTOR ANALYSIS 20

V. RESULTS OF THE REGRESSION ANALYSIS 22

VI. RESULTS OF THE CORRELATION ANALYSIS 25

VII. RESULTS OF THE SECOND REGRESSION ANALYSIS 28

VIII. REGRESSION MATRIX OF THE ECONOMIC GROWTH MODEL 30

IX. RESULTS OF THE SECOND FACTOR ANALYSIS 32

X. RESULTS OF THE DISCRIMINANT ANALYSIS 34

XI. RESULTS OF THE THREE STEPWISE DISCRIMINANT PROGRAMS. 36

XII. RESULTS OF THE CORRELATION ANALYSIS 37

XIII. RESULTS OF THE SECOND DISCRIMINANT ANALYSIS 39

XIX. RESULTS OF THE GROUP MEANS ANALYSIS 41

XV. RESULTS OF THE REGRESSION ON ALL GROUP 0 COUNTRIES 42

XVI. RESULTS OF THE REGRESSION ON ALL GROUP 1 COUNTRIES 44

XVII. RESULTS OF THE REGRESSION ON LATIN AMERICAN GROUP 0 COUNTRIES 46

XVIII. RESULTS OF THE REGRESSION ON THE REMAINING GROUP 0 COUNTRIES 47

XIX. RESULTS OF THE REGRESSION ON THE LATIN AMERICAN GROUP 1 COUNTRIES 49

XX. RESULTS OF THE REGRESSION ON THE REMAINING GROUP 1 COUNTRIES 50

XXI. RESULTS OF THE REGRESSION ON ALL GROUP 0 COUNTRIES USING THE DUMMY VARIABLES 51

XXII. RESULTS OF THE REGRESSION ON ALL GROUP 1 COUNTRIES USING THE DUMMY VARIABLE 52

I. INTRODUCTION

The purpose of this study is to examine the effects of defense and selected social expenditures upon economic growth. This examination involves a cross-sectional, multivariate analysis of socio-economic data gathered from 96 developing countries around the world. Particular attention is paid to the Latin American case to determine if these countries differ significantly from other countries of the world.

The first notable work involving factors that affect economic development was conducted by Benoit in the 1970's. Benoit found that his, "...evidence does not indicate that defense has any net adverse effect on growth in developing countries." [Ref. 1:p. XIX] Benoit further suggested that defense programs made some positive contribution to civilian economies, such as (1) providing manpower training, (2) supplying dual use infrastructure such as roads, bridges, ports and communications facilities, (3) construction by the military of schools and clinics and (4) providing security for civilians [Ref. 1:p. 17].

A recent study by Frederiksen and Looney hypothesized that, "...the impact of added defense expenditures may be either positive or negative and will depend on the resource constraints faced by individual developing nations." [Ref. 2:p. 113] They found that, "...defense expenditures do not compete excessively for scarce resources in countries which are relatively resource unconstrained...(While) countries suffering from a relative lack of resources experience no statistically discernible effect on economic growth from defense spending." [Ref. 2:p. 124]

As a follow-on to the above studies, this study intends to examine the relative contribution of defense and other government expenditures such as health and education to economic growth. This study should provide results that will add to a general theory of defense expenditures and economic growth.

The hypothesis of this study is that smaller less economically developed countries will sacrifice social expenditures in favor of defense while more economically dynamic countries will be able to maintain a desired level of defense preparedness while supporting social needs. This is based upon the assumption that military expenditures have a positive effect on economic growth while social expenditures have a negative effect on growth. The effect of defense and social expenditures on growth will be ascertained by the application of a regression equation upon the developing countries which will be divided into two groups according to their degree of urbanization and economic size (gross domestic product). The regression equation will reflect economic growth based upon variables derived from a factor analysis. The developing countries will be divided into economically dynamic groups through the use of a discriminant analysis.

Benoit's observation that, "Relatively secure areas like Latin America, ..., had generally low defense burdens" [Ref. 1:p. 2], led to a further investigation in this study to determine the uniqueness of the Latin American case. The regression equation will first be applied to the Latin American countries as a region and then to its economically dynamic groups of countries and compared in each instance to the corresponding group of the remaining developing countries of the world.

In Chapter II, a more detailed methodology is presented and followed in Chapter III by the findings of each step of the analysis. Finally, the conclusions indicate that the hypothesis is generally supported by the evidence.

II. METHOD OF STUDY

The principle methods of analysis used in this study were factor analysis, regression analysis and discriminant analysis. Several steps in the study were aided through the use of correlation analysis, stepwise regression analysis and stepwise discriminant analysis. The programs for each analysis utilized the Statistical Analysis System (SAS) [Ref. 3].

A. DATA AND VARIABLE SELECTION

The 96 developing countries selected for this are listed by region of the world in Table I. The principal variables reflecting economic and development were operationalized using economic and social variables chosen from an extensive data base. The data base was extracted from publications issued by the International Monetary Fund [Ref. 4], Yales University [Ref. 5], and the World Bank [Ref. 6]. Economic data were primarily used because (1) they are empirically observable, (2) they are valid in that they are directly indicative of growth and (3) they are reliable since they can be applied with consistent results and they apply the same measurement to all observations. The variables selected as shown in Table II were grouped as follows:

1. Economic Growth: Variables were chosen to reflect average annual growth in Gross National Product (GNP), Gross Domestic Product (GDP), investment, savings, imports and exports. The periods of annual growth

TABLE I

DEVELOPING COUNTRIES BY REGION

1. LATIN AMERICA - REGION 1:

NICARAGA
COSTA RICA
GUATEMALA
PARAGUAY
MEXICO
HAITI
ECUADOR
DOM. REP.
CHILE
ARGENTINA
TRINIDAD
HONDURAS
BOLIVIA
EL SALVADOR
VENEZUELA
BRAZIL
COLOMBIA
PANAMA
URUGUAY
JAMAICA
PERU

2. EUROPE - REGION 2:

GREECE
TURKEY
PORTUGAL

3. EUROPE -REGION 3:

YUGOSLAVIA
SPAIN

4. MIDDLE EAST - REGION 4:

ISRAEL
IRAQ
LEBANON
UAE
EGYPT
KUWAIT
JORDAN
IRAN
SYRIA
OMAN
SAUDI ARABIA
NORTH YEMEN
ADEN

5. ASIA - REGION 5:

INDIA
SRILANKA
AFGHANISTAN
BHUTAN
PAKISTAN
NEPAL
BANGLADESH

6. EAST ASIA - REGION 6:

TAIWAN
PHILIPPINES
BURMA
INDONESIA
HONG KONG
PAPUA
KOREA
THAILAND
LAOS
SINGAPORE
MALAYSIA
VIETNAM

7. AFRICA - REGION 7:

CAMEROON
SOMALIA
RWANDA
UPPER VOLTA
LIBERIA
SIERRA LEONE
UGANDA
GHANA
BURUNDI
ZIMBABWE
NIGERIA
TOGO
MALAWI
BENIN
IVORY COAST
CHAD
ETHIOPIA
MOZAMBIQUE
GUINEA
KENYA
SUDAN
TUNISIA
NIGERIA
ALGERIA
MAURITANIA
MADAGASCAR
CAR
ZAIRE
LESOTHO
SENEGAL
MOROCCO
MALI
LIBYA
CONGO
TANZANIA
ANGOLA
ZAMBIA
SOUTH AFRICA

TABLE II

DESCRIPTION FOR VARIABLES
USED IN THE
FIRST FACTOR ANALYSIS

GNPG78	AVERAGE ANNUAL GROWTH PER CAPITA OF GNP 1960-76
FPER78	INDEX OF AVERAGE PER CAPITA FOOD PRODUCTION 1974-76
EPPER78	AVERAGE ANNUAL GROWTH IN ENERGY PRODUCTION 1960-75 OF GNP 1970-82
PDPG78	AVERAGE ANNUAL GROWTH OF EXTERNAL PUBLIC DEBT AS A PERCENTAGE OF GNP 1970-76
LFGA84	AVERAGE ANNUAL GROWTH OF LABOR FORCE 1960-70
LFGB84	AVERAGE ANNUAL GROWTH OF LABOR FORCE 1970-82
UPPA84	URBAN POPULATION AS A PERCENTAGE OF TOTAL POPULATION 1960
UPPB84	URBAN POPULATION AS A PERCENTAGE OF TOTAL POPULATION 1982
UPGA84	AVERAGE ANNUAL GROWTH OF URBAN POPULATION 1960-70
UPGB84	AVERAGE ANNUAL GROWTH OF URBAN POPULATION 1970-82
YCGRY	CENTRAL GOVERNMENT CURRENT REVENUE AS A PERCENTAGE OF GDP
YMEYSG	AVERAGE ANNUAL GROWTH OF MILITARY EXPENDITURE AS A PERCENTAGE OF GNP 1965-78
YETYSG	AVERAGE ANNUAL GROWTH OF PUBLIC EDUCATION AND HEALTH EXPENDITURE AS A PERCENTAGE OF GNP 1965-78
YCCYSG	AVERAGE ANNUAL GROWTH OF GENERAL GOVERNMENT CONSUMPTION AS A PERCENTAGE OF GDP 1960-78
YPCYSG	AVERAGE ANNUAL GROWTH OF PRIVATE CONSUMPTION AS A PERCENTAGE OF GDP 1960-78
YIYSG	AVERAGE ANNUAL GROWTH OF GROSS DOMESTIC INVESTMENT AS A PERCENTAGE OF GDP 1965-78
YLFPAGSG	AVERAGE ANNUAL GROWTH OF THE PERCENTAGE OF LABOR IN AGRICULTURE 1960-77
YLFPISG	AVERAGE ANNUAL GROWTH OF THE PERCENTAGE OF LABOR IN INDUSTRY 1960-77
YLFPSSG	AVERAGE ANNUAL GROWTH OF THE PERCENTAGE OF LABOR IN SERVICES 1960-77
YCGCEY	CENTRAL GOVERNMENT CURRENT EXPENDITURES AS A PERCENTAGE OF GDP 1978
YGGNPPA	AVERAGE ANNUAL GROWTH OF GNP 1960-75
YGGNPPB	AVERAGE ANNUAL GROWTH OF GNP 1970-78
EXPG84	AVERAGE ANNUAL GROWTH OF EXPORTS 1960-82
GDPGB84	AVERAGE ANNUAL GROWTH OF GDP 1970-82
GDIGA84	AVERAGE ANNUAL GROWTH OF GROSS DOMESTIC INVESTMENT 1960-70
GDIGB84	AVERAGE ANNUAL GROWTH OF GROSS DOMESTIC INVESTMENT 1970-82
GDSVG84	AVERAGE ANNUAL GROWTH OF GROSS DOMESTIC SAVINGS 1960-82
DSGG84	AVERAGE ANNUAL GROWTH OF DEBT SERVICE AS A PERCENTAGE

ranged from 5 to 22 years during the time period from 1960 to 1982.

2. Structural Indicators: These variables measure government comsumption, revenues and debt. Private consumption, social spending and military expenditures were also included.

3. Other Indicators: These variables were chosen to reflect shifts in the population, the labor force, food production and energy production associated with general economic development.

B. FACTOR ANALYSIS

The first factor analysis applied in this study was used to determine the best indicators of economic growth. This analysis provides this information by reducing the 29 selected variables into a number of independent groups or factors. Each factor included variables that reflected some major aspect of economic growth. The weight a variable carried in a given factor was indicated by an associated number called its factor loading. The highest loading variable in each factor of the orthogonally rotated transformation matrix was then used to represent that factor in a subsequent regression analysis.

C. REGRESSION ANALYSIS

Regression analysis was used to develop the model equation for economic growth necessary to test the hypothesis of this study. Selected variables from the factor analysis provided the independent and dependent variables for the equation. The dependent variable was selected as the best indicator of economic growth. The independent variables with minimum correlation that were selected explained some proportion of the variance in the growth indicator variable. The test variables representing growth in military and social spending were added at this point to complete the model.

A stepwise regression analysis was utilized to determine the best order of the independent variables in the model. This analysis ranked the variables in order of their contribution to explaining the variance in the dependent variable.

The resulting model provided a gross indication of the relationship between military and social expenditures and economic growth for all of the developing countries in the study.

D. DISCRIMINANT ANALYSIS

Discriminant analysis was used to divide the 96 countries in this study into groups according to their level of development. The variables used in this analysis were selected by using the results from a second factor analysis and a stepwise discriminant analysis.

From this factor analysis the principle variables reflecting the level of economic development were operationalized using economic and social variables from the data base. At this point the data base was expanded to include data published by R. L. Sivard [Ref. 7]. In addition to several growth related variables from the first factor analysis more variables were added to reflect the absolute level of economic and social development in the years 1976 through 1982.

The variables are listed in Table III. Economic indicators included GDP, investment, savings, imports and exports. Structural indicators included government consumption, revenues and debt and private consumption, social and military expenditures. Other indicators included life expectancy, calories per capita and labor shifts.

The second factor analysis, like the first, provided independent groupings for the variables as factors. The leading variables in each of these factors were then put into the discriminant analysis.

The discriminant analysis divided the countries in the study into two groups based on the above input variables. The probability of the correct placement of each country in a group was also provided. These probabilities were used as a measure of how well the input variables used in the analysis split the countries into two groups. The standard for this study was to have a majority of the countries placement probability above 80 percent.

E. TEST OF THE MODEL

In order to provide the evidence necessary to support the hypothesis the model was tested. The test was conducted by applying the model to each of the two groups of countries derived from the discriminant analysis.

In order to prove the Latin American case the model was first applied to all the Latin American countries. Then the

TABLE III

DESCRIPTIONS FOR VARIABLES USED IN THE SECOND FACTOR ANALYSIS

ECPER78	Average annual growth in energy production 1960-75
GNPG78	Average annual growth per capita of GNP 1960-76
FPER78	Index of average per capita food production 1974-76
EPPER78	Average annual growth in energy production 1960-75
PDPB78	External public debt as a percentage of GNP 1976
MTZ78	Merchandise imports 1976
ZGB78	Average annual increase in imports 1970-76
LFGB84	Average annual growth of labor force 1970-82
UPPB84	Urban population as a percentage of total population 1982
UPGB84	Average annual growth of urban population 1970-82
YMEYSG	Average annual growth of military expenditure as a percentage of GNP 1965-78
YETYSG	Average annual growth of public education and health expenditure as a percentage of GNP 1965-78
YLFPAGSG	Average annual growth of the percentage of labor in agriculture 1960-77
YLFPISG	Average annual growth of the percentage of labor in industry 1960-77
YLFPSSG	Average annual growth of the percentage of labor in services 1960-77
EXPG84	Average annual growth of exports 1960-82
GDPGB84	Average annual growth of GDP 1970-82
GDIGB84	Average annual growth of gross domestic investment 1970-82
LE84	Life expectancy at birth 1982
MEB84	Machine and transport equipment as a percentage of merchandise exports 1981
OMEB84	Other manufactures as a percentage of merchandise exports 1981
GDPB84	GDP 1982
TEB84	Textile and clothing as a percentage of merchandise exports 1981
OPCEB84	Other primary commodities as a percentage of merchandise exports 1981
SGB84	Average annual growth of services 1970-82
IGB84	Average annual growth of industry 1970-82
MGB84	Average annual growth of manufacturing 1970-82
GDSB84	Gross domestic savings as a percentage of GDP 1982
DSGG84	Average annual growth of debt service as a percentage of GNP 1970-82
EB84	Exports of goods and services as a percentage of GDP 1982
AGB84	Average annual growth of agriculture 1970-82
FEB84	Fuels, minerals and metals as a percentage of merchandise exports 1981
SCP	Calories per capita 1979
SPW	Percentage of population with safe water 1979
SIMR	Infant mortality rate 1979]

model was applied to the two groups of Latin American countries provided by the discriminant analysis.

The results of each application of the model to the general world case and the specific case of Latin America were compared in order to support the hypothesis of this study.

III. FINDINGS OF THE STUDY

In this chapter the findings of the study are presented. Several tables are included to help summarize the results of the study. In addition to the findings some further methodologies are introduced that more accurately describe the actual progression of the study. These methodologies were utilized to better operationalize the principal hypothesis through a systematic and objective variable selection process.

A. RESULTS OF THE FIRST FACTOR ANALYSIS

As indicated in Chapter II the first factor analysis was applied in this study to determine the best indicators of economic growth. The results of the orthogonally rotated factor analysis, shown in Table IV, indicated that 99 percent of the variance in the 28 selected variables could be accounted for by six factors. Factor one grouped variables that reflected central government fiscal activity including revenues and expenses. Factor two depicted aggregate economic variables like GNP and GDP along with investment and savings. Factor three primarily reflected labor force movements in industry and services and GNP growth. Factor four included both government and private consumption variables along with several more labor shift variables. Factor five reflected the growth of the urban population. Factor six included both

TABLE IV

RESULTS OF THE FIRST FACTOR ANALYSIS

ROTATED FACTOR PATTERN

	FACTOR1	FACTOR2	FACTOR3	FACTOR4	FACTOR5	FACTOR
YC GRY	92 *	3	15	2	10	-9
YC GCEY	90 *	-10	-5	20	16	11
YE TYSG	71 *	-3	7	25	4	21
YME YSG	63 *	-13	-29	-14	23	8
EXPG84	63 *	36 *	28	-21	-4	21
YG GNPPB	1	64 *	13	15	-1	-4
GDPGB84	-4	84 *	-8	-30	-15	-16
GNPG78	32	77 *	0	24	5	16
GD IGB84	-16	67 *	11	-35 *	-8	-40*
GD IGA84	0	60 *	-29	-8	-11	52*
YI YSG	-21	59 *	11	9	15	2
GD SVG84	-5	58 *	42 *	-35 *	19	-5
YL FPISG	15	13	81 *	31	-2	5
YG GNPPA	17	3	81 *	35 *	-6	-19
YL FPSSG	-4	-3	80 *	24	29	-7
FP ER78	30	38 *	-41 *	-12	16	-16
FP PER78	36 *	-20	-49 *	-11	-11	6
UP GB84	-25	-13	-57 *	-4	-27	33
YP CYSG	-20	-4	37 *	73 *	23	-1
YG CYSG	33	-3	12	69 *	9	5
YL FPAGSG	-12	7	29	49 *	7	-3
LF GB84	-32	-2	-17	-62 *	24	18
LF GA84	4	11	-12	-70 *	20	14
UP PA84	17	9	14	0	95 *	-10
UP PB84	15	4	10	-3	93 *	15
DS CG84	40 *	4	17	2	30	65*
PD PG78	38 *	-27	-23	-17	1	65*
UP GA84	-7	-3	-26	-38 *	-13	58*

public debt and debt service variables and another urbanization indicator.

The values of the factor loadings shown in Table IV corresponded to the extent of the correlation between each variable and factor. The program flagged values greater than .34 with an asterisk. Only 28 countries were used on the analysis. The remaining 68 countires were omitted due to missing data.

The highest loading variables in each of the six factors were selected for the regression analysis. The variables included YGCRY, YGGNPPB, YLFPISG, YPCYSG, UPPA84 and DSGG84.

B. RESULTS OF THE REGRESSION ANALYSIS

In order to build a model equation for economic growth using the leading variables from each factor listed above were put into a regression analysis. Of the six variables available YGGNPPB was designated as the best dependent variable to represent overall economic growth. The remaining five variables were put into the program as independent variables.

The results of the regression analysis are shown in Table V. Based on 50 countries the correlation coefficient for the equation was only .0041. This result indicated that five independent variables explained less than one percent of the variation in YGGNPPB. The weakness of the equation was also apparent in the low f-value for the equation, the low t-statistic for each variable parameter and by the fact that the residual error of only three countries fell within two

TABLE V

RESULTS OF THE REGRESSION ANALYSIS

```
DEP VARIABLE: YGGNPPB
                       SUM OF           MEAN
SOURCE       DF       SQUARES         SQUARE        F VALUE        PROB>F
MODEL         5       342.410      68.482011          0.041        0.9990
ERROR        50     83070.350       1661.407
C TOTAL      55     83412.760
     ROOT MSE       40.760361       R-SQUARE         0.0041
     DEP MEAN        9.351786       ADJ R-SQ        -0.0955
     C.V.            435.8564

                    PARAMETER        T FOR HO:                   STANDARDIZED
VARIABLE     DF      ESTIMATE      PARAMETER=0     PROB > |T|       ESTIMATE

INTERCEP      1      8.395092            0.607         0.5468       0.000000
YLFPISG       1     -2.227256           -0.186         0.8535      -0.029922
YCGRY         1      0.210880            0.325         0.7463       0.051273
YPCYSG        1      1.511223            0.284         0.7776       0.045517
UPPA84        1     -0.024814           -0.093         0.9260      -0.014156
DSGG84        1     -0.447996           -0.245         0.8076      -0.035270

                              PREDICT             STD ERR  STUDENT
 OBS    ID          ACTUAL      VALUE  RESIDUAL  RESIDUAL  RESIDUAL    -2-1-0 1 2

  1  ISRAEL          1.600     11.537    -9.937    33.680    -0.295 |          |          |
  2  GREECE          3.300     10.379    -6.579    39.736    -0.166 |          |          |
  3  TAIWAN          5.700          .         .         .         .
  4  NICARAG         1.700      5.172    -3.472    37.463    -0.093 |          |          |
  5  INDIA           1.600          .         .         .         .
  6  HONDURAS 0.400000          6.593    -6.193    39.795    -0.156 |          |          |
  7  CAMEROON        2.300     10.755    -7.955    39.931    -0.199 |          |          |
  8  NIGERIA         4.400      8.818    -4.418    39.127    -0.113 |          |          |
  9  INDONES         5.300     10.552    -5.252    40.134    -0.131 |          |          |
 10  SUDAN           2.600      9.732    -7.132    39.704    -0.180 |          |          |
 11  COSTAR          3.300      7.247    -3.947    39.994    -0.099 |          |          |
 12  BOLIVIA         3.100      6.118    -3.018    39.278    -0.077 |          |          |
 13  SENEGAL     -.300000       9.873   -10.173    40.283    -0.253 |          |          |
 14  SOMALIA     -.100000           .         .         .         .
 15  EGYPT           6.300     11.507    -5.207    37.857    -0.138 |          |          |
 16  TOGO     0.700000          8.430    -7.730    38.309    -0.199 |          |          |
 17  TUNISIA         5.700          .         .         .         .
 18  MOROCCO         3.900      8.471    -4.571    38.889    -0.118 |          |          |
 19  KOREA           8.100      4.326     3.774    36.931     0.102 |          |          |
 20  RWANDA          1.400      9.940    -8.540    39.298    -0.217 |          |          |
 21  GUATEM          3.300      8.547    -5.247    39.476    -0.133 |          |          |
 22  AFGHAN          2.700          .         .         .         .
 23  MALAWI          3.100      8.543    -5.443    39.771    -0.137 |          |          |
 24  NIGER       -.600000       9.282    -9.882    38.809    -0.255 |          |          |
 25  SINGAPOR        6.600      7.417 -.816554    34.874    -0.023 |          |          |
 26  ELSALV          2.200      9.901    -7.701    39.492    -0.195 |          |          |
 27  MALI            1.800     10.841    -9.041    39.768    -0.227 |          |          |
 28  PAKISTAN        1.500          .         .         .         .
 29  UPPERVOL       -1.000     10.874   -11.874    39.766    -0.299 |          |          |
 30  BENIN           1.400     10.413    -9.013    39.593    -0.228 |          |          |
 31  TURKEY          4.100      9.874    -5.774    40.258    -0.143 |          |          |
 32  YUGOSLV         5.000          .         .         .         .
 33  SPAIN           3.100     10.513    -7.413    38.973    -0.190 |          |          |
 34  PARAGUA         4.500      9.720    -5.220    39.512    -0.132 |          |          |
 35  VENEZUEL        3.100      9.520    -6.420    39.112    -0.164 |          |          |
 36  IRAN           13.300          .         .         .         .
 37  MEXICO          1.300      7.036    -5.736    39.521    -0.145 |          |          |
 38  BRAZIL          6.000          .         .         .         .
 39  ALGERIA         2.600          .         .         .         .
 40  PHILIPP         3.700      7.427    -3.727    39.487    -0.094 |          |          |
 41  HONGKONG        6.900          .         .         .         .
 42  LIBYA          -2.600          .         .         .         .
 43  ECUADOR         5.600      3.365     2.235    37.669     0.059 |          |          |
 44  COLOMBIA        3.600      7.953    -4.353    39.301    -0.111 |          |          |
 45  THILAND         4.500      8.610    -4.110    39.932    -0.103 |          |          |
 46  MALAYSIA        4.800      9.205    -4.405    40.041    -0.110 |          |          |
```

TABLE V (cont'd)

```
                            PREDICT                STD ERR  STUDENT
OBS   ID          ACTUAL     VALUE  RESIDUAL RESIDUAL RESIDUAL     -2-1-0 1 2

47 DOMINR          4.200     8.355    -4.155   39.580   -0.105 |        |        |
48 LIBERIA     0.200000     10.498   -10.298   40.223   -0.256 |        |        |
49 IVORYCOA    0.900000          .         .        .        .
50 MAURIT      -.600000      8.523    -9.123   39.246   -0.232 |        |        |
51 CONGO       0.200000          .         .        .        .
52 SIERRAL        -1.300         .         .        .        .
53 PANAMA      0.500000      4.113    -3.613   34.193   -0.106 |        |        |
54 CHILE           2.100         .         .        .        .
55 CHAD        -.600000     12.407   -13.007   39.328   -0.331 |        |        |
56 URUGUAY         1.800     9.341    -7.541   37.781   -0.200 |        |        |
57 MADAGAS        -2.700    10.181   -12.881   39.935   -0.323 |        |        |
58 TANZANIA        1.700    11.941   -10.241   39.456   -0.260 |        |        |
59 UGANDA         -2.800         .         .        .        .
60 ETHIOPIA    -.100000     10.528   -10.628   39.685   -0.263 |        |        |
61 CAR             1.000         .         .        .        .
62 ANGOLA        -10.500         .         .        .        .
63 GHANA          -3.000    10.950   -13.950   39.536   -0.353 |        |        |
64 BANGLAD     0.200000          .         .        .        .
65 MOZAMBIQ       -5.500         .         .        .        .
66 PORTUGAL        6.900    13.581    -6.681   31.368   -0.213 |        |        |
67 BURMA           1.700         .         .        .        .
68 SRILANKA        1.900    11.439    -9.539   39.935   -0.239 |        |        |
69 ZAIRE          -2.200     8.870   -11.070   39.763   -0.278 |        |        |
70 ARGENTIN        3.100    10.276    -7.176   32.753   -0.219 |        |        |
71 JAMAICA         3.600     3.999 -.399267    33.697   -0.012 |        |        |
72 TRINIDAD        2.500     9.699    -7.199   32.406   -0.222 |        |        |
73 ZAMBIA      -.900000     10.120   -11.020   40.143   -0.274 |        |        |
74 PERU        0.300000      9.387    -9.087   37.562   -0.242 |        |        |
75 PAPUA           3.800         .         .        .        .
76 BURUNDI         1.300    12.627   -11.327   38.706   -0.293 |        |        |
77 GUINEA      0.300000          .         .        .        .
78 LESOTHO         4.600         .         .        .        .
79 SOUTHAF         1.580         .         .        .        .
80 SAUDIAR         6.000         .         .        .        .
81 ZIMBAB              .         .         .        .        .
82 IRAQ            7.700         .         .        .        .
83 KUWAIT      0.600000     18.373   -17.773   31.427   -0.566 |       *|        |
84 KENYA         140.000     8.654   131.346   39.773    3.302 |        |******|
85 SYRIA         261.000    11.349   249.651   40.013    6.239 |        |******|
86 NYEMEN              .         .         .        .        .
87 LAOS          -15.800         .         .        .        .
88 VIETNAM             .         .         .        .        .
89 BHUTAN      -.200000          .         .        .        .
90 LEBANON             .         .         .        .        .
91 JORDAN          7.000         .         .        .        .
92 NEPAL       0.300000          .         .        .        .
93 HAITI           2.200         .         .        .        .
94 OMAN            3.700         .         .        .        .
95 ADEN                .         .         .        .        .
96 UAE            -5.600         .         .        .        .
SUM OF RESIDUALS          6.7501
SUM OF SQUARED RESIDUALS     830
```

standard deviations of center. This model, while objective, was not considered significant enough to represent economic growth. The standard for the model was set at having a correlation coefficient of .50 or better. Due to these results an alternative method for variable selection was deemed necessary.

The second iteration of the variable selection was more subjective. A single factor was chosen from the factor analysys that best represented overall economic growth. Factor two was selected since it contained three aggregate measures of GNP and GDP along with other indicators of domestic investment and savings. In order to select the best variables for the model another product of the factor analysis, the correlation analysis, was consulted.

As shown in Table VI the variables in the correlation analysis were listed in a matrix. The variables in factor two are listed horizontally while all 28 variables are listed vertically. Correlation values are indicated for each pair of variables with values above .35 flagged with an asterisk. The objective of the variable selection using the correlation table was to select a dependent variable then select independent variables that are highly correlated with it but not correlated with each other.

In this investigation YGGNPPB, GDPGB84 and GNPG78 were chosen as possible dependent variables. GDIGA84, GDIGB84, YIYSG and GDSVG84 were chosen as possible independent

TABLE VI

RESULTS OF THE CORRELATION ANALYSIS

	CORRELATIONS						
	YGGNPPB	GDPGB84	GNPG78	GDIGB84	GDIGA84	YIYSG	GDSVG84
YGGNPPB	100 *	61 *	73 *	50	53	49 *	41 *
GDPGB84	61 *	100 *	51 *	86	43	45 *	59 *
GNPG78	73 *	51 *	100 *	27	64	31	41 *
GDIGB84	50 *	86 *	27	100	10	44 *	57 *
GDIGA84	53 *	43 *	64 *	10	100	28	25
YIYSG	49 *	45 *	31	44	28	100 *	40 *
GDSVG84	41 *	59 *	41 *	57	25	40 *	100 *
YETYSG	5	-15	22	-31	-1	-10	-19
YMEYSG	-17	-6	9	-14	4	-25	-19
YGGCLY	-10	-18	30	-27	-8	-25	-20
YGGRY	2	-2	34	-5	-12	-12	5
YGCYSG	1	-20	22	-28	-21	16	-24
YPCYSG	5	-27	3	-14	-31	28	-10
YGGNPPA	21	-12	10	1	-35	19	24
YLFPAGSG	10	6	12	13	-21	9	-3
YLFPISG	36 *	-7	24	0	-12	6	26
YLFPSSG	2	-21	-3	0	-43	8	32
FPER78	30	42 *	31	26	20	21	12
EPPER78	-34	-10	-5	-32	11	-31	-29
EXPG84	35 *	24	45 *	13	29	11	38 *
DSGG84	0	-17	31	-31	23	1	11
LFGA84	-12	36 *	-9	34	11	16	29
LFGB84	-8	16	-31	19	14	-4	15
UPPA84	3	-19	9	-10	-18	11	25
UPPB84	3	-15	18	-15	0	11	25
UPGA84	-27	14	-9	-1	33	5	-5
UPGB84	-22	1	-16	-15	35	-10	-40 *
PDPG78	-30	-26	-9	-45	28	-29	-29

variables. The first step in reducing the possibilities was to select the dependent and independent variables with the highest correlation. The table showed that GDPGB84 and GDIGB84 had the highest correlation which was 86. Then using GDPGB84 as the best dependent variable the other independent variables were tested with it. GDSVG84 had the next highest correlation at 59 but was deleted due to its high correlation with GDIGB84 at 57. YIYSG had a correlation with GDPGB84 of 45 but was deleted since it measured gross domestic investment over a similar period as GDIGB84. GDIGA84 had a correlation value of 43 and was selected for the equation. In sum, the analysis of the correlation values produced GDPGB84 as the independent variable for the equation with GDIGB84 and GDIGA84 as the independent variables. At this point the two test variables, YMEYSG and YETYSG, were introduced as independent variables into the equation. These two variables also did not correlate highly with the other independent variables.

Having the principal and test variables for the growth equation model the next step taken was to do a stepwise regression analysis. This was done to determine if the variables collectively yielded a significant correlation and, if so, to find the best order of the independent variables in the equation.

The results of the stepwise regression analysis were based on data from 56 countries. The independent variables provided by the analysis in order of their contribution to the variation in GDPGB84 were:

(1) GDIGB84 with an r-squared of .60,

(2) YMEYSG with a cumulative r-squared of .63 and

(3) GDIGA84 with a cumulative r-squared of .65.

YETYSG did not meet the .15 significance level for entry into the equation but was retained as a test variable for the subsequent regression analysis.

The results of the regression analysis are shown in Table VII. Of the 96 countries in the sample 40 were deleted due to missing data. Each country is listed with an estimate of GDPGB84 based on the independent variables selected for the equation. Also shown are the residuals, a plot of the student's residual and Cook's D. Based on the r-squared value of .65 the independent variables explain 65 percent of the variation in GDPGB84. For each of the independent variables and the intercept a parameter estimate, a t-statistic and other information is provided. The F-value for the equation is 23.7 with a probability just under 100 percent. The degrees of freedom for the equation is 55. Table VIII summarizes some of this data as variables were added to the equation. The lack of fluctuation in the values of the parameter estimate for each variable confirmed that the independent variables have little or no correlation between themselves.

TABLE VII

RESULTS OF THE SECOND REGRESSION ANALYSIS

```
DEP VARIABLE: GDPGB84
                        SUM OF            MEAN
SOURCE       DF        SQUARES          SQUARE          F VALUE          PROB>F
MODEL         4        248.857       62.214234           23.706          0.0001
ERROR        51        133.845        2.624416
C TOTAL      55        382.702
     ROOT MSE         1.620005        R-SQUARE           0.6503
     DEP MEAN         4.132143        ADJ R-SQ           0.6223
     C.V.             38.73624

                     PARAMETER        T FOR H0:                       STANDARDIZED
VARIABLE     DF       ESTIMATE      PARAMETER=0       PROB > |T|        ESTIMATE

INTERCEP      1       2.092759            5.425           0.0001        0.000000
GDIGB84       1       0.333721            9.248           0.0001        0.785640
YMEYSG        1       2.350634            1.779           0.0812        0.156156
GDIGA84       1       0.068621            1.637           0.1079        0.138188
YETYSG        1      -0.399613           -0.357           0.7229       -0.031193

                             PREDICT                   STD ERR   STUDENT
OBS    ID          ACTUAL      VALUE   RESIDUAL   RESIDUAL  RESIDUAL     -2-1-0 1 2

 1 ISRAEL           3.100      4.205     -1.105      1.104    -1.001  |     **|      |
 2 GREECE           4.100      3.244   0.855798      1.590     0.538  |       |*     |
 3 TAIWAN               .          .          .          .         .
 4 NICARAG       0.600000      2.276     -1.676      1.563    -1.072  |     **|      |
 5 INDIA            3.600      3.955   -.354696      1.593    -0.223  |       |      |
 6 HONDURAS         4.200      4.362   -.162453      1.592    -0.102  |       |      |
 7 CAMEROON         7.000      5.814      1.186      1.594     0.744  |       |*     |
 8 NIGERIA          3.800      6.053     -2.253      1.568    -1.437  |     **|      |
 9 INDONES          7.700          .          .          .         .
10 SUDAN            6.300      5.525   0.774754      1.573     0.492  |       |      |
11 COSTAR           4.500          .          .          .         .
12 BOLIVIA          3.700      2.167      1.533      1.545     0.992  |       |*     |
13 SENEGAL          2.900      2.750   0.149604      1.585     0.094  |       |      |
14 SOMALIA          3.300          .          .          .         .
15 EGYPT            8.400      7.650   0.750416      1.490     0.503  |       |*     |
16 TOGO             3.000      4.901     -1.901      1.513    -1.257  |     **|      |
17 TUNISIA          7.000      6.003   0.997203      1.583     0.630  |       |*     |
18 MOROCCO          5.000          .          .          .         .
19 KOREA            8.600      7.703   0.896782      1.416     0.633  |       |*     |
20 RWANDA           5.300          .          .          .         .
21 GUATEM           5.000      4.507   0.493224      1.603     0.308  |       |      |
22 AFGHAN               .          .          .          .         .
23 MALAWI           5.100      4.190   0.910345      1.496     0.608  |       |*     |
24 NIGER            3.400      4.187   -.787256      1.585    -0.497  |       |      |
25 SINGAPOR         3.500          .          .          .         .
26 ELSALV           2.200      2.737   -.587485      1.595    -0.363  |       |      |
27 MALI             7.100      4.166      2.934      1.594     1.841  |       |***   |
28 PAKISTAN         3.000          .          .          .         .
29 UPPERVOL         3.400          .          .          .         .
30 BENIN            3.300      6.392     -3.092      1.576    -1.962  |    ***|      |
31 TURKEY           5.100      4.422   0.677574      1.596     0.425  |       |      |
32 YUGOSLV          5.500      4.350      1.150      1.590     0.723  |       |*     |
33 SPAIN            3.100      2.884   0.216302      1.577     0.137  |       |      |
34 PARAGUA          8.500      8.016   0.483801      1.540     0.314  |       |      |
35 VENEZUEL         4.100      4.123   -.022928      1.602    -0.014  |       |      |
36 IRAN                 .          .          .          .         .
37 MEXICO           6.400      5.326      1.074      1.593     0.674  |       |*     |
38 BRAZIL           7.600      4.368      3.232      1.584     2.040  |       |****  |
39 ALGERIA          6.600      5.363      1.237      1.536     0.805  |       |*     |
40 PHILIPP          6.000      6.093   -.092508      1.546    -0.060  |       |      |
41 HONGKONG         9.900          .          .          .         .
42 LIBYA            2.400          .          .          .         .
43 ECUADOR          8.100          .          .          .         .
44 COLOMBIA         5.400      4.424   0.976031      1.593     0.613  |       |*     |
45 THILAND          7.100      5.466      1.634      1.563     1.046  |       |**    |
46 MALAYSIA         7.700      6.377      1.323      1.576     0.839  |       |*     |
47 DOMINR           6.000      4.980      1.020      1.574     0.648  |       |*     |
```

TABLE VII (cont'd)

```
OBS   ID         ACTUAL      VALUE   RESIDUAL   RESIDUAL   RESIDUAL    -2-1-0 1 2

48 LIBERIA     0.900000      2.395     -1.495      1.526     -0.979 |      *|       |
49 IVCRYCOA       5.700      6.365  -.665397       1.556     -0.428 |       |       |
50 MAURIT         7.400      5.113      2.287      1.456      1.570 |       |***    |
51 CONGO          6.300          .          .          .          .
52 SIERRAL        2.000          .          .          .          .
53 PANAMA         4.700      3.263      1.437      1.565      0.918 |       |*      |
54 CHILE          1.900      2.893  -.992933       1.591     -0.624 |      *|       |
55 CHAD          -2.600   0.310334     -2.910      1.546     -1.882 |    ***|       |
56 URUGUAY        3.100          .          .          .          .
57 MADAGAS     0.200000          .          .          .          .
58 TANZANIA       4.000      4.444  -.444028       1.574     -0.282 |       |       |
59 UGANDA        -1.500   0.358301     -1.859      1.469     -1.266 |     **|       |
60 ETHIOPIA       2.200      2.778  -.578261       1.592     -0.363 |       |       |
61 CAR            1.400  -.341379      1.741      1.525      1.142 |       |**     |
62 ANGOLA             .          .          .          .          .
63 GHANA       -.500000   0.028684  -.528684       1.501     -0.352 |       |       |
64 BANGLAD        4.100          .          .          .          .
65 MOZAMBIQ           .          .          .          .          .
66 PORTUGAL       4.500      2.671      1.829      1.468      1.247 |       |**     |
67 BURMA          5.000      4.992   0.008043      1.568      0.005 |       |       |
68 SRILANKA       4.500      6.284     -1.784      1.572     -1.135 |     **|       |
69 ZAIRE       -.200000      3.871     -4.071      1.526     -2.668 |  *****|       |
70 ARGENTIN       1.500      2.954     -1.454      1.586     -0.916 |      *|       |
71 JAMAICA       -1.100  -.090365     -1.010      1.452     -0.695 |      *|       |
72 TRINIDAD       5.500      5.396   0.103672      1.537      0.067 |       |       |
73 ZAMBIA      0.900000  -.475964      1.376      1.473      0.934 |       |*      |
74 PERU           3.000      3.802  -.802365       1.561     -0.514 |      *|       |
75 PAPUA          2.000          .          .          .          .
76 BURUNDI        3.500          .          .          .          .
77 GUINEA         3.300          .          .          .          .
78 LESOTHO        6.600      9.950     -3.350      1.420     -2.359 |   ****|       |
79 SOUTHAF        3.600          .          .          .          .
80 SAUDIAR        3.600          .          .          .          .
81 ZIMBAB         2.200          .          .          .          .
82 IRAQ               .          .          .          .          .
83 KUWAIT         2.100          .          .          .          .
84 KENYA          5.500      3.621      1.879      1.593      1.179 |       |**     |
85 SYRIA          8.300          .          .          .          .
86 NYEMEN         8.500          .          .          .          .
87 LAOS               .          .          .          .          .
88 VIETNAM            .          .          .          .          .
89 BHUTAN             .          .          .          .          .
90 LEBANON            .          .          .          .          .
91 JORDAN         9.300          .          .          .          .
92 NEPAL          2.700          .          .          .          .
93 HAITI          3.400      4.587     -1.187      1.577     -0.753 |      *|       |
94 OMAN           5.800          .          .          .          .
95 ADEN               .          .          .          .          .
96 UAE                .          .          .          .          .
  SUM OF RESIDUALS              1.3873
  SUM OF SQUARED RESIDUALS         133
```

TABLE VIII

REGRESSION MATRIX OF THE ECONOMIC GROWTH MODEL

	INDEPENDENT VARIABLES				STATISTICS		
EQUATION	GDIGB84	YMEYSG	GDIGA84	YETYSG	R-SQ	F	DF
1.GDPGB84=							
2.	.22 (6.97)				.39	43.5	76
3.	.22 (6.83)	-1.21 (-.85)			.40	23.4	71
4.	.31 (9.26)	1.73 (1.35)	.09 (2.22)		.61	30.8	62
5.	.33 (9.24)	2.35 (1.78)	.07 (1.64)	-.40 (-.36)	.65	23.7	55

NOTES: 1. SEE TEXT FOR DEFINITION OF VARIABLES.
2. ( ) = T STATISTIC.
3. R-SQ = CORRELATION COEFFICIENT.
4. F = F STATISTIC.
5. DF = DEGREES OF FREEDOM.

The resulting model was constructed:

$$GDPGB84 = 2.1 + .33\ GDIGB84 + 2.35\ YMEYSG + .07\ GDIGA84 - .36\ YETYSG$$

This model provides a gross indication through the signs (+ or -) that military expenditures are positively related to growth while social expenditures are negatively related to economic growth. Further analysis was conducted to divide the sample of 96 developing countries into relatively rich and poor groups through the use of factor and discriminant analysis.

C. RESULTS OF THE DISCRIMINANT ANALYSIS

In order to divide the 96 developing countries into two groups according to their overall level of development two further analytical steps were necessary. The first step involved another variable selection using a second factor analysis. The second step involved taking the variables produced by the factor analysis and using them to conduct a discriminant analysis.

Using the 35 variables contained in Table III which reflected levels of development as well as economic growth a second factor analysis was conducted. The results of this factor analysis, shown in Table IX, are in the form of a orthogonal transformation matrix. The program specified that 99 percent of the variance in the input variables could be accounted for by six factors. Factor one grouped variables

TABLE IX

RESULTS OF THE SECOND FACTOR ANALYSIS

ROTATED FACTOR PATTERN

	FACTOR1	FACTOR2	FACTOR3	FACTOR4	FACTOR5	FACTOR
YCGRY	92 *	3	15	2	10	-9
YCGCEY	90 *	-10	-5	20	16	11
YETYSG	71 *	-3	7	25	4	21
YMEYSG	63 *	-13	-29	-14	23	8
EXPG84	63 *	36 *	28	-21	-4	21
YGGNPPB	1	64 *	13	15	-1	-4
GDPGB84	-4	84 *	-8	-30	-15	-16
GNPG78	32	77 *	0	24	5	16
GDIGB84	-16	67 *	11	-35 *	-8	-40*
GDIGA84	0	60 *	-29	-8	-11	52*
YIYSG	-21	59 *	11	9	15	2
GDSVG84	-5	58 *	42 *	-35 *	19	-5
YLFPISG	15	13	81 *	31	-2	5
YGGNPPA	17	3	81 *	35 *	-6	-19
YLFPSSG	-4	-3	80 *	24	29	-7
FPER78	30	38 *	-41 *	-12	16	-16
FPPER78	36 *	-20	-49 *	-11	-11	6
UPGB84	-25	-13	-57 *	-4	-27	33
YPCYSG	-20	-4	37 *	73 *	23	-1
YUCYSG	33	-3	12	69 *	9	5
YLFPAGSG	-12	7	29	49 *	7	-3
LFGB84	-32	-2	-17	-62 *	24	18
LFGA84	4	11	-12	-70 *	20	14
UPPA84	17	0	14	0	95 *	-10
UPPB84	15	4	10	-3	93 *	15
DSCG84	40 *	4	17	2	30	65*
PDPG78	38 *	-27	-23	-17	1	65*
UPGA84	-7	-3	-26	-38 *	-13	58*

that reflect energy consumption, life expectancy in 1982, calories per capita, merchandise imports and exports, and urbanization. Factor two depicted growth in GDP, industry, services, manufacturing, and domestic investment. Factor three was predominated by variables that reflected the growth of exports. Factor four consisted primarily of labor shifts in agriculture and industry. Factor five consisted solely of fuels, minerals and metals exports. Factor six reflected the labor shift in services and also the two test variables, YMEYSG and YETYSG. Only 43 countries were used by the program. The remaining countries were omitted due to missing data. The highest loading variables in each of the factors were selected for use in the subsequent discriminant analysis.

A discriminant analysis was run using the six variables from the factor analysis. These variables included ECPER78, GDPGB84, EB84, YLFPAGSG, FEB84 and YLFPSSG. The results of the discriminant analysis are shown in Table X. In the first column the table listed the 57 countries for which data was available according to the variables selected. The second column listed the original group, 0 or 1, in which each country was placed on an 'a priori' basis. The third column listed the group into which each country was placed by the program based on the six variables used for the analysis. An asterisk, added by the program, indicated that the group status of a country was changed from its 'a priori' designation. The last two columns indicate the posterior probability

TABLE X

RESULTS OF THE DISCRIMINANT ANALYSIS

COUNTRY	FROM GROUP	CLASSIFIED INTO GROUP	POSTERIOR PROBABILITY OF MEMBERSHIP IN GROUP: 0	1
ISRAEL	0	0	0.5670	0.4330
GREECE	1	1	0.3012	0.6988
NICARAG	0	0	0.9209	0.0791
INDIA	1	0 *	0.7707	0.2293
HONDURAS	0	0	0.8155	0.1845
CAMEROON	0	1 *	0.3829	0.6171
INDONES	1	1	0.0937	0.9063
SUDAN	0	1 *	0.4800	0.5200
COSTAR	0	0	0.7922	0.2078
SENEGAL	0	0	0.7923	0.2072
EGYPT	1	1	0.1284	0.8716
TOGO	0	0	0.7688	0.2312
TUNISIA	0	1 *	0.2576	0.7424
MOROCCO	0	1 *	0.4836	0.5164
KOREA	1	1	0.2210	0.7790
GUATEM	0	0	0.6643	0.3357
MALAWI	0	0	0.7557	0.2443
NIGER	0	0	0.5933	0.4067
SINGAPOR	0	0	0.9434	0.0566
ELSALV	0	0	0.8857	0.1143
UPPERVOL	0	0	0.8526	0.1474
TURKEY	0	1 *	0.4633	0.5367
YUGOSLV	0	1 *	0.2401	0.7599
SPAIN	1	1	0.4081	0.5919
VENEZUEL	1	1	0.0624	0.9376
BRAZIL	1	1	0.1874	0.8126
ALGERIA	1	1	0.0604	0.9396
PHILIPP	1	1	0.4517	0.5483
HONGKONG	0	0	0.5936	0.4064
LIBYA	1	1	0.4629	0.5371
COLUMBIA	1	1	0.4208	0.5792
THILAND	1	1	0.4637	0.5363
MALAYSIA	1	1	0.3239	0.6761
DOMINR	0	0	0.7999	0.2001
LIBERIA	0	0	0.9121	0.0879
IVORYCOA	0	0	0.7212	0.2788
CONGO	0	1 *	0.2915	0.7085
SIERRAL	0	0	0.8850	0.1150
PANAMA	0	0	0.5850	0.4150
CHILE	0	0	0.6672	0.3328
URUGUAY	0	0	0.7473	0.2527
MADAGAS	0	0	0.9522	0.0478
TANZANIA	0	0	0.7612	0.2388
ETHIOPIA	0	0	0.8939	0.1061
CAR	0	0	0.9507	0.0493
PORTUGAL	0	0	0.8399	0.1601
SRILANKA	0	0	0.7989	0.2011
ARGENTIN	1	0 *	0.7751	0.2249
JAMAICA	0	0	0.8004	0.1996
TRINIDAD	0	1 *	0.0501	0.9499
PERU	0	0	0.7489	0.2511
SAUDIAR	1	0 *	0.8696	0.1304
KUWAIT	1	1	0.0058	0.9942
KENYA	0	0	0.5641	0.4359
NYEMEN	0	0	0.7010	0.2990
JORDAN	1	1	0.2121	0.7879
NEPAL	0	0	0.8964	0.1036

* MISCLASSIFIED OBSERVATION

of placement by the program into either group 0 or group 1. As indicated in Chapter II, the standard for this study was to have the placement probability for most of the countries above 80 percent. As shown in the table only 21 of the 57 countries meet the 80 percent criterion. At this point another process, the stepwise discriminant analysis, was applied to the 35 selected variables in an attempt to achieve more acceptable results for the discriminant analysis.

The stepwise discriminant analysis used a selection process to find which variables among the 35 variables used for this segment of the study that best showed the differences between the country groupings. The 35 variables were divided and put into three stepwise discriminant analysis programs since all of the variables could not be handled by a single program. The results of the three programs are shown in Table XI. Each summary listed the results for the corresponding input variables. The summary also included data on the number of steps taken in the analysis to find the best discriminating variables for the two groups. Wilks' lambda, which is the program's primary selection tool, the F-statistic and the r-squared values for each step are also included.

Since three programs were run in the stepwise discriminant analysis, action was deemed necessary to ensure that correlation between the output variables was minimized prior to their use in a final discriminant analysis. The correlation analysis shown in Table XII was consulted. This table

TABLE XI

RESULTS OF THE THREE STEPWISE DISCRIMINANT PROGRAMS

```
1.  STEPWISE SELECTION:  SUMMARY

           VARIABLE        PARTIAL      F       PROB >     WILKS'     PROB >
 STEP  ENTERED  REMOVED     R**2    STATISTIC     F        LAMBDA     LAMBDA

   1   MTZ78                0.4106     27.863  0.0001  0.58942003   0.0000
   2   SGB34                0.0814      3.454  0.0706  0.54146013   0.0000
2.  STEPWISE SELECTION:  SUMMARY

           VARIABLE        PARTIAL      F       PROB >     WILKS'     PROB >
 STEP  ENTERED  REMOVED     R**2    STATISTIC     F        LAMBDA     LAMBDA

   1   GDPB84               0.4588     46.620  0.0001  0.54123057   0.0000
   2   GDPGB34              0.0662      3.828  0.0556  0.50539393   0.0000
3.  STEPWISE SELECTION:  SUMMARY

           VARIABLE        PARTIAL      F       PROB >     WILKS'     PROB >
 STEP  ENTERED  REMOVED     R**2    STATISTIC     F        LAMBDA     LAMBDA

   1   UPPB84               0.1411      9.034  0.0040  0.85891863   0.0040
   2   GDPGB34              0.1127      6.857  0.0114  0.76214535   0.0007
   3   PDPB73               0.0990      5.822  0.0193  0.68671283   0.0002
   4   YLFPA3SG             0.0566      3.117  0.0833  0.64737389   0.0001
   5   YETYS3               0.0442      2.360  0.1307  0.61922164   0.0001
```

TABLE XII

RESULTS OF THE CORRELATION ANALYSIS

				CORRELATIONS				
	UPPB84	GDPGB84	PDPB78	YLFPAGSG	YETYSG	MTZ78	SGB84	GDPB84
UPPB84	100 *	14	-15	-43 *	11	73 *	0	49*
GDPGB84	14	100 *	27	-21	-13	13	86 *	-2
PDPB78	-15	27	100 *	-13	-40 *	-41 *	36	-40*
YLFPAGSG	-43 *	-21	-13	100 *	22	-34	-3	-27
YETYSG	11	-13	-40 *	22	100 *	16	-13	13
MTZ78	73 *	13	-41 *	-34	16	100 *	6	87*
SGB84	0	88 *	36	-3	-13	6	100 *	-1
GDPB84	49 *	-2	-40 *	-27	13	37 *	-1	100*
GDIGB84	13	81 *	38	-25	-12	4	73 *	-1
YMEYSG	-26	21	33	-23	-32	-29	19	-31
FPER78	44 *	24	-16	-32	35	28	18	16
YLFPISG	37	33	-9	35	24	42 *	31	15
YLFPSSG	-1	0	-26	23	40	10	-11	0
GNPG78	49 *	29	-39	1	29	57 *	15	28
EXPG84	25	36	21	-11	10	-1	17	-24
DSGG84	14	37	37	12	22	-14	25	-27
LFGB84	-24	38	58 *	-22	-8	-39	30	-32
UPGB84	-43 *	-1	43 *	0	9	-49 *	-2	-41*
EPPER78	-39	-4	10	-14	-6	-39	-4	-42*
ECPER78	77 *	2	-44 *	-23	32	81 *	-7	56*
ZGB78	53 *	67 *	30	-42 *	6	36	60 *	20
LE84	53 *	21	-56 *	-6	20	67 *	10	44*
AGB84	-13	47 *	30	-51 *	-23	-20	25	-22
IGB84	22	88 *	3	-22	-16	19	62 *	5
MGB84	25	83 *	15	-32	0	27	67 *	11
GDSB84	32	46 *	1	-46 *	16	39	23	35
EB84	23	35	22	-10	11	-3	17	-25
FEB84	17	21	50 *	-25	-4	-7	22	-14
UPCEB84	-67 *	-26	9	20	-13	-58 *	-13	-45*
TEB84	29	22	-26	26	16	31	22	32
MEL84	52 *	14	-51 *	-17	28	81 *	-1	67*
OMEB84	55 *	-10	-58 *	2	7	62 *	-29	57*
SIMR	-43 *	-34	51 *	3	-13	-62 *	-21	-37
SCP	77 *	22	-30	-14	31	64 *	14	34
SPW	63 *	44 *	-5	-10	11	61 *	47 *	37

was produced by the second factor analysis. Correlations above 50 were considered unacceptable. The variable selection began with the elimination of MTZ78 which had a correlation of 73 with UPPB84 and one of 87 with GDPB84. The only other correlation above 50 was between SGB84 and GDPGB84. The choice between the two variables was based on data availability. GDPGB84 was selected since its data was available for 84 countries while data for SGB84 was available for only 72 countries. With the loss of SGB84 and MTZ78 a decision was made to include FPER78 into the group of variables for the subsequent discriminant analysis. This decision was based on the need for an additional variable in the group to reflect the possibilities for the human condition. In sum, the variables selected for the discriminant analysis now included UPPB84, GDPGB84, PDPB78, YLFPAGSG, YETYSG, GDPB84 and FPER78.

The results of the discriminant analysis using the variables listed above are shown in Table XIII. The analysis produced 67 countries with 48 countries placed in group 0 and 19 countries placed in group 1. Only 13 countries had a probability of placement below 80 percent. In sum, the results of the discriminant analysis were considered acceptable.

The final phase of the discriminant analysis was to determine the economic size represented by the two groups. This determination was made through the examination of the mean values of the variables used to discriminate between the two

TABLE III

RESULTS OF THE SECOND DISCRIMINANT ANALYSIS

			POSTERIOR PROBABILITY OF MEMBERSHIP IN GROUP:	
COUNTRY	FROM GROUP	CLASSIFIED INTO GROUP	0	1
ISRAEL	0	0	0.9585	0.0415
GREECE	1	0 *	0.5841	0.4159
NICARAG	0	0	0.9646	0.0354
INDIA	1	1	0.0353	0.9647
HONDURAS	0	0	0.9609	0.0391
CAMEROON	0	0	0.7930	0.2070
NIGERIA	1	1	0.1561	0.8439
SUDAN	0	0	0.9627	0.0373
BOLIVIA	0	0	0.9584	0.0416
SENEGAL	0	0	0.9326	0.0674
EGYPT	1	1	0.4530	0.5470
TOGO	0	0	0.9623	0.0377
TUNISIA	0	0	0.8756	0.1244
MOROCCO	0	0	0.8562	0.1438
KOREA	1	1	0.0187	0.9813
GUATEM	0	0	0.7594	0.2406
MALAWI	0	0	0.9801	0.0199
NIGER	0	0	0.9088	0.0912
SINGAPOR	0	0	0.6253	0.3747
ELSALV	0	0	0.9318	0.0682
MALI	0	0	0.8865	0.1135
UPPERVOL	0	0	0.9440	0.0560
BENIN	0	0	0.9547	0.0453
TURKEY	0	1 *	0.3501	0.6499
YUGOSLV	0	1 *	0.1724	0.8276
SPAIN	1	1	0.0006	0.9994
PARAGUA	0	1 *	0.3781	0.6219
VENEZUEL	1	1	0.0313	0.9687
MEXICO	1	1	0.0003	0.9997
BRAZIL	1	1	0.0000	1.0000
ALGERIA	1	1	0.3344	0.6656
PHILIPP	1	1	0.2668	0.7332
LIBYA	1	1	0.4166	0.5834
ECUADOR	0	1 *	0.3057	0.6943
COLUMBIA	1	1	0.1559	0.8441
THILAND	1	0 *	0.5369	0.4631
MALAYSIA	1	0 *	0.8522	0.1478
DOMINR	0	0	0.9023	0.0977
LIBERIA	0	0	0.9917	0.0083
IVORYCOA	0	0	0.9609	0.0391
MAURIT	0	0	0.9607	0.0393
SIERRAL	0	0	0.9862	0.0138
PANAMA	0	0	0.9655	0.0345
CHILE	0	0	0.6414	0.3586
CHAD	0	0	0.9916	0.0084
TANZANIA	0	0	0.9944	0.0056
UGANDA	0	0	0.9808	0.0192
ETHIOPIA	0	0	0.9475	0.0525
CAR	0	0	0.9662	0.0338
GHANA	0	0	0.7987	0.2013
PORTUGAL	0	0	0.9651	0.0349
BURMA	0	0	0.7748	0.2252
SRILANKA	0	0	0.9498	0.0502
ZAIRE	0	0	0.9996	0.0004
ARGENTIN	1	1	0.1178	0.8822
JAMAICA	0	0	0.9908	0.0092
TRINIDAD	0	0	0.8490	0.1510
ZAMBIA	0	0	0.9967	0.0033
PERU	0	0	0.9004	0.0996
LESOTHO	0	0	0.9950	0.0050
SAUDIAR	1	1	0.0072	0.9928
ZIMBAB	0	0	0.9966	0.0034
KENYA	0	0	0.9291	0.0709
SYRIA	1	1	0.1238	0.8762
JORDAN	1	1	0.0491	0.9509
NEPAL	0	0	0.9742	0.0258
HAITI	0	0	0.9920	0.0080

* MISCLASSIFIED OBSERVATION

groups. As shown in Table XIV, the mean values of GDP, the growth of GDP, and urbanization are higher for group 1 than for group 0. So for the purposes of this study countries in group 1 were designated more economically dynamic while the countries in group 0 were designated less economically dynamic. In sum, the group membership of each country in this phase of the study and the identity of that group was considered certain enough to provide a basis for the test of the hypothesis using the model for economic growth.

D. RESULTS OF THE TEST OF THE MODEL

The economic growth model derived in Section B of this chapter was tested in order to provide evidence to support the hypothesis. This evidence would be in the algebraic sign of the test variables, YMEYSG and YETYSG. The model was tested by applying it to each of the two groups, the less economically dynamic countries or group 0 and the more economically dynamic countries or group 1, found through the discriminant analysis. In order to test the uniqueness of the Latin American case the model was applied to the remaining group 0 and group 1 countries respectively. The results of each test were then compared. Another test of the Latin American case involved the addition of a dummy variable into the economic growth model and testing the group 0 and group 1 countries again.

The results of the model test for the 45 countries in group 0 are shown in Table XV. In the variable and parameter

TABLE XIV

RESULTS OF THE GROUP MEANS ANALYSIS

VARIABLE	GROUP 0	GROUP 1
UPPB84	34.79	52.76
GDPGB84	3.68	5.60
PDPB78	25.26	15.79
YLFPAGSG	.08	-.79
YEIYSG	.08	.01
FPER78	99.29	110.33
GDPB84	9049.85	84572.67

TABLE XV

RESULTS OF THE REGRESSION ON ALL GROUP 0 COUNTRIES

```
DEP VARIABLE: GDPGB84
                        SUM OF          MEAN
SOURCE       DF        SQUARES        SQUARE       F VALUE        PROB>F
MODEL         4        163.773     40.943347        13.332        0.0001
ERROR        34        100.641      2.960029
C TOTAL      38        264.414
    ROOT MSE          1.720473      R-SQUARE        0.6194
    DEP MEAN          3.558974      ADJ R-SQ        0.5746
    C.V.              48.34133

                     PARAMETER      T FOR HO:                STANDARDIZED
VARIABLE     DF       ESTIMATE    PARAMETER=0    PROB > |T|      ESTIMATE

INTERCEP      1       2.043234          4.453        0.0001      0.000000
GDIGB84       1       0.312176          7.111        0.0001      0.771723
YMEYSG        1       3.236297          2.093        0.0434      0.242939
GDIGA84       1       0.047549          0.870        0.3902      0.094843
YETYSG        1      -0.360613         -0.262        0.7950     -0.030511

                            PREDICT              STD ERR   STUDENT
OBS  ID           ACTUAL      VALUE  RESIDUAL  RESIDUAL  RESIDUAL    -2-1-0 1 2

  1  ISRAEL        3.100      4.897    -1.797     1.118    -1.607  |     ***|     |
  2  NICARAG    0.600000      2.080    -1.480     1.640    -0.902  |       *|     |
  3  HONDURAS      4.200      4.039  0.160507     1.680     0.096  |        |     |
  4  CAMEROON      7.000      5.366     1.634     1.676     0.975  |        |*    |
  5  SUDAN         6.300      5.331  0.968835     1.657     0.585  |        |*    |
  6  BOLIVIA       3.700      1.934     1.766     1.613     1.091  |        |**   |
  7  SENEGAL       2.900      2.641  0.259189     1.672     0.155  |        |     |
  8  TOGO          3.000      4.565    -1.565     1.582    -0.989  |       *|     |
  9  TUNISIA       7.000      5.640     1.360     1.661     0.819  |        |*    |
 10  MOROCCO       5.000          .         .         .         .
 11  GUATEM        5.000      4.170  0.830167     1.690     0.491  |        |     |
 12  MALAWI        5.100      3.865     1.235     1.507     0.820  |        |*    |
 13  NIGER         3.400      3.826  -.425737     1.666    -0.255  |        |     |
 14  SINGAPOR      3.500          .         .         .         .
 15  ELSALV        2.200      2.644  -.443858     1.688    -0.263  |        |     |
 16  MALI          7.100      3.906     3.194     1.673     1.904  |        |***  |
 17  UPPERVOL      3.400          .         .         .         .
 18  BENIN         3.300      5.963    -2.663     1.644    -1.620  |     ***|     |
 19  MALAYSIA      7.700      5.953     1.747     1.657     1.054  |        |**   |
 20  DOMINR        6.000      4.417     1.583     1.645     0.962  |        |*    |
 21  LIBERIA    0.900000      2.369    -1.469     1.576    -0.932  |       *|     |
 22  IVORYCOA      5.700      5.905  -.204858     1.631    -0.126  |        |     |
 23  MAURIT        7.400      5.342     2.058     1.513     1.360  |        |**   |
 24  SIERRAL       2.000          .         .         .         .
 25  PANAMA        4.700      2.983     1.717     1.643     1.045  |        |**   |
 26  CHILE         1.900      2.636  -.735999     1.679    -0.436  |        |     |
 27  CHAD         -2.600   0.264989    -2.865     1.631    -1.756  |     ***|     |
 28  TANZANIA      4.000      4.353  -.353231     1.658    -0.213  |        |     |
 29  UGANDA       -1.500   0.423293    -1.923     1.527    -1.263  |      **|     |
 30  ETHIOPIA      2.200      2.605  -.404769     1.684    -0.240  |        |     |
 31  CAR           1.400  -.280440     1.680     1.606     1.046  |        |**   |
 32  GHANA     -.500000   0.066026  -.566026     1.568    -0.361  |        |     |
 33  PORTUGAL      4.500      2.231     2.269     1.500     1.512  |        |***  |
 34  BURMA         5.000      4.471  0.528767     1.639     0.323  |        |     |
 35  SRILANKA      4.500      5.852    -1.352     1.630    -0.829  |       *|     |
 36  ZAIRE     -.200000      3.173    -3.373     1.597    -2.115  |    ****|     |
 37  JAMAICA      -1.100  -.105577  -.994423     1.473    -0.675  |       *|     |
 38  TRINIDAD      5.500      5.165  0.335371     1.590     0.211  |        |     |
 39  ZAMBIA     0.900000  -.371392     1.271     1.515     0.839  |        |*    |
 40  PERU          3.000      3.849  -.849229     1.644    -0.516  |       *|     |
 41  LESOTHO       6.600      9.052    -2.452     1.404    -1.746  |     ***|     |
 42  ZIMBAB        2.200          .         .         .         .
 43  KENYA         5.500      3.357     2.143     1.673     1.277  |        |**   |
 44  NEPAL         2.700          .         .         .         .
 45  HAITI         3.400      4.212  -.812135     1.651    -0.492  |        |     |
SUM OF RESIDUALS           3.3972
SUM OF SQUARED RESIDUALS       10
```

section of the table the sign of YMEYSG was positive and the t-statistic was significant with a value of 2.098. The value of YETYSG was negative with a t-statistic of only -.262. This t-statistic value was well below the 2.00 standard set for the study making the YETYSG variable not statistically significant in determining GDPGB84. This meant that the effect of YETYSG on economic growth could not be identified with any certainty using this text.

The results of the model test for the countries in group 1 are shown in Table XVI. For this test the sign of YMEYSG was negative and the t-statistic was significant with a value of -3.217. The sign of YETYSG was also negative but its t-statistic was -1.177. Again the effect of YETYSG on economic growth could not be determined.

Since the relationship of YETYSG to economic growth could not be determined using the above test another model was introduced. This model simply looked at the relationship between the two test variables with YETYSG as the dependent variable and YMEYSG as the independent variable. This model was then tested on group 0 and group 1 countries.

The results of the second model test on the group 0 countries were as follows (t-statistics in parenthesis):

$$\begin{aligned} \text{YETYSG} &= .094 + \underset{(2.176)}{.465\ \text{YMEYSG}} \\ \text{r-squared} &= .10 \end{aligned}$$

TABLE XVI

RESULTS OF THE REGRESSION ON ALL GROUP 1 COUNTRIES

```
DEP VARIABLE: GDPGB84
                          SUM OF           MEAN
SOURCE         DF        SQUARES         SQUARE        F VALUE        PROB>F
MODEL           4      48.292423      12.073106         14.916        0.0005
ERROR           9       7.284720       0.809413
C TOTAL        13      55.577143
      ROOT MSE          0.899674       R-SQUARE         0.8639
      DEP MEAN          5.414286       ADJ R-SQ         0.8107
      C.V.             16.61667

                        PARAMETER     T FOR H0:                     STANDARDIZED
VARIABLE       DF       ESTIMATE    PARAMETER=0    PROB > |T|         ESTIMATE

INTERCEP        1       1.518514          2.417        0.0388         0.000000
GDIGB84         1       0.346391          5.584        0.0003         0.704710
YMEYSG          1      -8.532925         -3.217        0.0105        -0.459146
CDIGA84         1       0.163636          3.162        0.0115         0.427476
YETYSG          1      -2.121129         -1.027        0.3313        -0.136951

                               PREDICT             STD ERR  STUDENT
OBS          ID      ACTUAL      VALUE  RESIDUAL  RESIDUAL  RESIDUAL     -2-1-0 1 2

  1  INDIA            3.600      4.593  -.992523  0.832355    -1.084   |     **|     |
  2  NIGERIA          3.800      3.939  -.138750  0.601736    -0.314   |       |     |
  3  KOREA            8.600      8.304  0.296421  0.436942     0.678   |       |*    |
  4  TURKEY           5.100      4.786  0.314426  0.810182     0.388   |       |     |
  5  YUGOSLV          5.500      4.390     1.110  0.798010     1.391   |       |**   |
  6  SPAIN            3.100      3.907  -.807113  0.692042    -1.166   |     **|     |
  7  PARAGUA          8.500      9.672    -1.172  0.606079    -1.934   |    ***|     |
  8  VENEZUEL         4.100      4.919  -.818923  0.840076    -0.975   |      *|     |
  9  MEXICO           6.400      5.780  0.619775  0.813785     0.762   |       |*    |
 10  BRAZIL           7.600      6.342     1.258  0.674671     1.865   |       |***  |
 11  ALGERIA          6.600      6.151  0.443755  0.703169     0.634   |       |*    |
 12  PHILIPP          6.000      5.751  0.249403  0.681748     0.366   |       |     |
 13  ECUADOR          8.100          .         .         .         .
 14  COLUMBIA         5.400      5.543  -.143203  0.805411    -0.178   |       |     |
 15  ARGENTIN         1.500      1.764  -.264054  0.679194    -0.389   |       |     |
 16  SAUDIAR          3.600          .         .         .         .
 17  SYRIA            8.300          .         .         .         .
 18  JORDAN           9.300          .         .         .         .
SUM OF RESIDUALS               1.6431
SUM OF SQUARED RESIDUALS           7.
```

Though YMEYSG explains only 10 percent of the variation in YETYSG its sign was a positive sign and statistically significant.

The results of the second model test on the group 1 countries were as follows:

$$\text{YETYSG} = .021 - \underset{(-3.172)}{.591}\ \text{YMEYSG}$$

$$r\text{-squared} = .59$$

In this model YMEYSG explains 59 percent of the variation in YETYSG. The negative sign of YMEYSG indicated an inverse relationship between the two variables which was statistically significant.

The first test of the Latin American case involved comparing the Latin American group 0 countries with the remaining group 0 countries using the economic growth model. The results of the test on the Latin American group 0 countries are shown in Table XVIII. In this test the resulting values for both YMEYSG and YETYSG were not statistically significant with t-statistic values of .554 and -.350 respectively. The results of the test on the remaining group 0 countries are shown in Table XVIII. Again the values of both test variables were not statistically significant with lot t-statistic values.

The second test of the Latin American case involved the comparison of the Latin American group 1 countries with the remaining group 1 countries. The results of this test are

TABLE XVII

RESULTS OF THE REGRESSION ON LATIN AMERICAN GROUP 0 COUNTRIES

```
DEP VARIABLE: GDPGB84
                          SUM OF           MEAN
SOURCE      DF           SQUARES         SQUARE        F VALUE        PROB>F
MODEL        4         38.401055       9.600264          7.113        0.0130
ERROR        7          9.448112       1.349730
C TOTAL     11         47.849167
      ROOT MSE          1.161779       R-SQUARE         0.8025
      DEP MEAN          3.258333       ADJ R-SQ         0.6897
      C.V.             35.65562

                       PARAMETER      T FOR H0:                   STANDARDIZED
VARIABLE    DF          ESTIMATE    PARAMETER=0    PROB > |T|        ESTIMATE

INTERCEP     1          0.910733          1.032        0.3365        0.000000
CDIGB84      1          0.422877          4.545        0.0027        1.024384
YMEYSG       1          2.438523          0.554        0.5966        0.103544
GDICA84      1          0.185369          2.115        0.0722        0.427930
YETYSG       1         -0.663979         -0.350        0.7369       -0.085237

                                PREDICT                 STD ERR   STUDENT
OBS     ID          ACTUAL        VALUE  RESIDUAL  RESIDUAL  RESIDUAL     -2-1-0 1 2

  1  NICARAG     0.600000        2.209    -1.609  0.966725    -1.664   |    ***|    |
  2  HONDURAS       4.200        4.740  -.539870  0.928125    -0.582   |      *|    |
  3  BOLIVIA        3.700        1.998     1.702  0.813014     2.093   |       |****|
  4  GUATEM         5.000        4.752  0.248013     1.070     0.232   |       |    |
  5  ELSALV         2.200        2.121  0.078945     1.048     0.075   |       |    |
  6  DOMINR         6.000        5.784  0.215592  0.859469     0.251   |       |    |
  7  PANAMA         4.700        3.548     1.152  0.906007     1.272   |       |**  |
  8  CHILE          1.900        2.889  -.988580     1.090    -0.907   |      *|    |
  9  JAMAICA       -1.100       -1.176  0.076173  0.482241     0.158   |       |    |
 10  TRINIDAD       5.500        4.861  0.638505  0.820893     0.773   |       |*   |
 11  PERU           3.000        3.059  -.059024  0.607615    -0.097   |       |    |
 12  HAITI          3.400        4.315  -.914950  0.851785    -1.074   |     **|    |
SUM OF RESIDUALS                 9.3258
SUM OF SQUARED RESIDUALS            9.4
```

TABLE XVIII

RESULTS OF THE REGRESSION ON THE REMAINING GROUP 0 COUNTRIES

```
DEP VARIABLE: GDPG884
                           SUM OF           MEAN
SOURCE        DF          SQUARES         SQUARE        F VALUE        PROB>F
MODEL          4          130.194      32.548573          8.444        0.0003
ERROR         22        84.804226       3.854733
C TOTAL       26          214.999
     ROOT MSE            1.963349       R-SQUARE         0.6056
     DEP MEAN            3.692593       ADJ R-SQ         0.5338
     C.V.                53.16992

                        PARAMETER       T FOR HO:                     STANDARDIZED
VARIABLE      DF         ESTIMATE    PARAMETER=0   PROB > |T|         ESTIMATE

INTERCEP       1         2.163645          3.075       0.0013         0.000000
GDIG884        1         0.305681          5.197       0.0001         0.755071
YMEYSG         1         3.244764          1.737       0.0964         0.261134
GDIGA84        1         0.017335          0.220       0.8212         0.032833
YETYSG         1         0.221572          0.118       0.9069         0.018060

                            PREDICT                  STD ERR   STUDENT
OBS   ID          ACTUAL      VALUE   RESIDUAL  RESIDUAL  RESIDUAL    -2-1-0 1 2

 1  ISRAEL         3.100      5.202     -2.102     1.210    -1.733  |    ***|    |
 2  CAMEROON       7.000      5.210      1.790     1.900     0.942  |       |*   |
 3  SUDAN          6.300      5.418   0.881884     1.866     0.472  |       |    |
 4  SENEGAL        2.900      2.748   0.152109     1.891     0.080  |       |    |
 5  TOGO           3.000      4.630     -1.630     1.741    -0.936  |      *|    |
 6  TUNISIA        7.000      5.616      1.384     1.871     0.740  |       |*   |
 7  MOROCCO        5.000          .          .         .         .
 8  MALAWI         5.100      3.361      1.739     1.602     1.085  |       |**  |
 9  NIGER          3.400      3.852   -.451874     1.882    -0.240  |       |    |
10  SINGAPOR       3.500          .          .         .         .
11  MALI           7.100      3.784      3.316     1.893     1.751  |       |*** |
12  UPPERVOL       3.400          .          .         .         .
13  BENIN          3.300      5.863     -2.563     1.838    -1.394  |     **|    |
14  MALAYSIA       7.700      5.906      1.794     1.877     0.956  |       |*   |
15  LIBERIA     0.900000      2.712     -1.812     1.741    -1.041  |     **|    |
16  IVORYCOA       5.700      5.771   -.070928     1.840    -0.039  |       |    |
17  MAURIT         7.400      5.547      1.853     1.654     1.120  |       |**  |
18  SIERRAL        2.300          .          .         .         .
19  CHAD          -2.000   0.318989     -2.319     1.834    -1.592  |    ***|    |
20  TANZANIA       4.000      4.263   -.263223     1.876    -0.140  |       |    |
21  UGANDA        -1.500   0.212535     -1.713     1.660    -1.032  |     **|    |
22  ETHIOPIA       2.200      2.516   -.316239     1.904    -0.166  |       |    |
23  CAR            1.400   -.195380      1.595     1.802     0.885  |       |*   |
24  GHANA      -.500000    0.219695   -.719695     1.753    -0.409  |       |    |
25  PORTUGAL       4.500      2.387      2.113     1.593     1.326  |       |**  |
26  BURMA          5.000      4.393   0.607250     1.843     0.330  |       |    |
27  SRILANKA       4.500      5.606     -1.106     1.813    -0.610  |      *|    |
28  ZAIRE      -.200000       2.900     -3.100     1.785    -1.737  |    ***|    |
29  ZAMBIA     0.900000    -.275493      1.175     1.553     0.754  |       |*   |
30  LESOTHO        5.600      6.572     -1.972     1.549    -1.273  |     **|    |
31  ZIMBAB         2.200          .          .         .         .
32  KENYA          5.500      3.165      2.335     1.886     1.238  |       |**  |
33  NEPAL          2.700          .          .         .         .
SUM OF RESIDUALS              2.1094
SUM OF SQUARED RESIDUALS         84.
```

shown in Table XIX. The values of YMEYSG and YETYSG were not statistically significant with t-statistic values of -.951 and -.093 respectively. The results of the remaining group 1 countries are shown in Table XX. The value for YMEYSG for this test was negative and statistically significant with a t-statistic value of -2.049. The value of YETYSG was not statistically significant.

The third test for the uniqueness of the Latin American case involved the use of a dummy variable. The dummy variable was introduced as an independent variable in the economic growth model with a value of 0 for Latin American countries and 1 for all other countries. The results of the test for all 45 group 0 countries are shown in Table XXI. The t-statistic value for the dummy variable was -.222 which indicated that there was no structural difference between the Latin American group 0 countries and the remaining group 0 countries.

The results of the dummy variable test for all the group 1 countries are shown in Table XXII. The t-statistic for the dummy variable was below 2.000 again. This indicated that there was also no structural difference between the Latin American group 1 countries and the remaining group 1 countries.

TABLE XIX

RESULTS OF THE REGRESSION ON THE LATIN AMERICAN GROUP 1 COUNTRIES

```
DEP VARIABLE: GDPGB84
                       SUM OF           MEAN
SOURCE        DF      SQUARES         SQUARE          F VALUE          PROB>F
MODEL          4    38.401055       9.600264            7.113          0.0130
ERROR          7     9.448112       1.349730
C TOTAL       11    47.849167
      ROOT MSE       1.161779       R-SQUARE           0.8025
      DEP MEAN       3.258333       ADJ R-SQ           0.6897
      C.V.          35.65562

                    PARAMETER      T FOR H0:                     STANDARDIZED
VARIABLE   DF        ESTIMATE   PARAMETER=0      PROB > |T|          ESTIMATE

INTERCEP    1        0.910733         1.032          0.3365          0.000000
CDIGB84     1        0.422077         4.545          0.0027          1.024384
YMEYSG      1        2.438523         0.554          0.5966          0.103544
GDIGA84     1        0.185969         2.115          0.0722          0.427930
YETYSG      1       -0.663979        -0.350          0.7369         -0.065237

                           PREDICT                STD ERR    STUDENT
OBS    ID        ACTUAL      VALUE  RESIDUAL     RESIDUAL   RESIDUAL    -2-1-0 1 2

  1 NICARAG   0.600000      2.209    -1.609    0.966725     -1.664   |   ***|    |
  2 HONDURAS     4.200      4.740  -.539870    0.928125     -0.582   |     *|    |
  3 BOLIVIA      3.700      1.998     1.702    0.813014      2.093   |      |****|
  4 GUATEM       5.000      4.752  0.243013       1.070      0.232   |      |    |
  5 ELSALV       2.200      2.121  0.078945       1.048      0.075   |      |    |
  6 DOMINR       6.000      5.784  0.215592    0.859469      0.251   |      |    |
  7 PANAMA       4.700      3.548     1.152    0.906007      1.272   |      |**  |
  8 CHILE        1.900      2.839  -.938580       1.090     -0.907   |     *|    |
  9 JAMAICA     -1.100     -1.176  0.076173    0.482241      0.158   |      |    |
 10 TRINIDAD     5.500      4.861  0.638505    0.820893      0.773   |      |*   |
 11 PERU         3.000      3.059  -.059024    0.607615     -0.097   |      |    |
 12 HAITI        3.400      4.315  -.914950    0.851785     -1.074   |    **|    |
SUM OF RESIDUALS             9.3258
SUM OF SQUARED RESIDUALS        9.4
```

TABLE XX

RESULTS OF THE REGRESSION ON THE REMAINING GROUP 1 COUNTRIES

```
DEP VARIABLE: GDPGR84
                        SUM OF          MEAN
SOURCE        DF       SQUARES        SQUARE       F VALUE       PROB>F
MODEL          4     21.084714      5.271178         7.736       0.0622
ERROR          3      2.044036      0.681345
C TOTAL        7     23.128750
     ROOT MSE         0.825436      R-SQUARE        0.9116
     DEP MEAN         5.287500      ADJ R-SQ        0.7938
     C.V.            15.61109

                     PARAMETER       T FOR HO:                   STANDARDIZED
VARIABLE      DF      ESTIMATE     PARAMETER=0    PROB > |T|       ESTIMATE

INTERCEP       1      0.538207           0.502        0.6504       0.000000
GDIGR84        1      0.477514           4.536        0.0201       0.915932
YHEYSG         1     -8.315835          -2.049        0.1328      -0.554811
GDIGA84        1      0.164125           3.091        0.0537       0.630208
YETYSG         1     -0.578435          -0.183        0.8668      -0.049827

                            PREDICT                 STD ERR   STUDENT
OBS         ID      ACTUAL    VALUE  RESIDUAL  RESIDUAL  RESIDUAL     -2-1-0 1 2

  1 INDIA           3.600    4.417 -.816939 0.726831    -1.124    |     **|     |
  2 NIGERIA         3.800    4.178 -.377375 0.284454    -1.329    |     **|     |
  3 KOREA           8.600    8.686 -.086308 0.133397    -0.647    |      *|     |
  4 TURKEY          5.100    4.311 0.289336 0.720096     0.402    |       |     |
  5 YUGOSLV         5.500    4.527 0.972849 0.706434     1.377    |       |**   |
  6 SPAIN           3.100    3.223 -.122758 0.442550    -0.277    |       |     |
  7 ALGERIA         6.600    6.822 -.221557 0.380148    -0.583    |      *|     |
  8 PHILIPP         6.000    5.637 0.363352 0.243091     1.495    |       |**   |
  9 SAUDIAR         3.600        .        .        .         .
 10 SYRIA           3.800        .        .        .         .
 11 JORDAN          9.300        .        .        .         .
SUM OF RESIDUALS              2.4424
SUM OF SQUARED RESIDUALS         2.0
```

TABLE XXI

RESULTS OF THE REGRESSION ON ALL GROUP 0 COUNTRIES USING THE DUMMY VARIABLE

```
DEP VARIABLE: GDPGB84
                          SUM OF             MEAN
SOURCE      DF           SQUARES           SQUARE          F VALUE          PROB>F
MODEL        5           163.917        32.783376           10.765          0.0001
ERROR       33           100.497         3.045378
C TOTAL     38           264.414
     ROOT MSE           1.745101         R-SQUARE           0.6199
     DEP MEAN           3.558974         ADJ R-SQ           0.5623
     C.V.               49.03382

                       PARAMETER          T FOR HO:                  STANDARDIZED
VARIABLE    DF          ESTIMATE        PARAMETER=0     PROB > |T|       ESTIMATE

INTERCEP     1          2.136135              3.378         0.0019       0.000000
GDIGB84      1          0.313508              6.975         0.0001       0.775017
YMEYSG       1          3.269797              2.080         0.0454       0.245504
GDIGA84      1          0.046529              0.337         0.4088       0.092807
YETYSG       1         -0.353204             -0.255         0.7992      -0.030307
DUM          1         -0.133501             -0.217         0.8295      -0.023664

                              PREDICT                  STD ERR   STUDENT
OBS    ID            ACTUAL     VALUE  RESIDUAL     RESIDUAL  RESIDUAL     -2-1-0 1 2

  1 ISRAEL          3.100      4.88    -1.782        1.132    -1.574  |     ***|      |
  2 NICARAG      0.600000      2.16    -1.561        1.622    -0.962  |       *|      |
  3 HONDURAS        4.200      4.13  0.069930        1.652     0.042  |        |      |
  4 CAMEROON        7.000      5.32     1.671        1.691     0.988  |        |*     |
  5 SUDAN           6.300      5.30  0.996106        1.676     0.594  |        |*     |
  6 BOLIVIA         3.700      2.01     1.686        1.600     1.054  |        |**    |
  7 SENEGAL         2.900      2.60  0.298402        1.687     0.177  |        |      |
  8 TOGO            3.000      4.52    -1.525        1.594    -0.957  |       *|      |
  9 TUNISIA         7.000      5.61     1.390        1.679     0.828  |        |*     |
 10 MOROCCO         5.000                   .            .         .
 11 GUATEM          5.000      4.26  0.737883        1.660     0.444  |        |      |
 12 MALAWI          5.100      3.81     1.286        1.511     0.851  |        |*     |
 13 NIGER           3.400      3.73  -.336894        1.681    -0.200  |        |      |
 14 SINGAPOR        8.500                   .            .         .
 15 ELSALV          2.200      2.73  -.535495        1.659    -0.323  |        |      |
 16 MALI            7.100      3.86     3.233        1.693     1.910  |        |***   |
 17 UPPERVOL        3.400                   .            .         .
 18 BENIN           3.300      5.93    -2.633        1.661    -1.585  |     ***|      |
 19 MALAYSIA        7.700      5.92     1.779        1.674     1.062  |        |**    |
 20 DOMINR          6.000      4.50     1.497        1.620     0.924  |        |*     |
 21 LIBERIA      0.900000      2.33    -1.435        1.591    -0.902  |       *|      |
 22 IVORYCOA        5.700      5.86  -.167868        1.645    -0.102  |        |      |
 23 MAURIT          7.400      5.32     2.074        1.535     1.352  |        |**    |
 24 SIERRAL         2.000                   .            .         .
 25 PANAMA          4.700      3.06     1.633        1.621     1.007  |        |**    |
 26 CHILE           1.900      2.72  -.819770        1.659    -0.494  |        |      |
 27 CHAD           -2.600   0.21237    -2.812        1.637    -1.718  |     ***|      |
 28 TANZANIA        4.000      4.31  -.316346        1.673    -0.189  |        |      |
 29 UGANDA         -1.500   0.37307    -1.873        1.528    -1.226  |      **|      |
 30 ETHIOPIA        2.200      2.56  -.359651        1.696    -0.212  |        |      |
 31 CAR             1.400   -.33333     1.733        1.611     1.076  |        |**    |
 32 GHANA       -.500000   0.01829  -.518296        1.575    -0.329  |        |      |
 33 PORTUGAL        4.500      2.17     2.321        1.503     1.544  |        |***   |
 34 BURMA           5.000      4.43  0.567863        1.653     0.344  |        |      |
 35 SRILANKA        4.500      5.81    -1.319        1.646    -0.801  |       *|      |
 36 ZAIRE       -.200000      3.12    -3.323        1.600    -2.077  |    ****|      |
 37 JAMAICA        -1.100   -.02893    -1.071        1.452    -0.738  |       *|      |
 38 TRINIDAD        5.500      5.27  0.226242        1.533     0.148  |        |      |
 39 ZAMBIA      0.900000   -.43072     1.331        1.513     0.880  |        |*     |
 40 PERU            3.000      3.95  -.952855        1.598    -0.596  |       *|      |
 41 LESOTHO         6.600      9.01    -2.417        1.415    -1.708  |     ***|      |
 42 ZIMBAB          2.200                   .            .         .
 43 KENYA           5.500      3.31     2.189        1.688     1.297  |        |**    |
 44 NEPAL           2.700                   .            .         .
 45 HAITI           3.400      4.30  -.909486        1.614    -0.564  |       *|      |
SUM OF RESIDUALS               4.085
SUM OF SQUARED RESIDUALS          10
```

TABLE XXII

RESULTS OF THE REGRESSION ON ALL GROUP 1 COUNTRIES USING THE DUMMY VARIABLE

```
DEP VARIABLE: CDPGB84
                         SUM OF            MEAN
SOURCE      DF          SQUARES          SQUARE          F VALUE          PROB>F
MODEL        4        48.292423       12.073106           14.916          0.0005
ERROR        9         7.284720        0.809413
C TOTAL     13        55.577143
     ROOT MSE          0.899674        R-SQUARE           0.8689
     DEP MEAN          5.414286        ADJ R-SQ           0.8107
     C.V.             16.61667

                      PARAMETER       T FOR H0:                      STANDARDIZED
VARIABLE    DF         ESTIMATE     PARAMETER=0    PROB > |T|         ESTIMATE

INTERCEP     1         1.518514           2.417        0.0388         0.000000
GDIGB84      1         0.346391           5.534        0.0003         0.704710
YMEYSG       1        -8.532925          -3.217        0.0105        -0.459146
CDIGA84      1         0.163636           3.162        0.0115         0.427476
YETYSG       1        -2.121129          -1.027        0.3313        -0.136051

                                PREDICT               STD ERR   STUDENT
OBS          ID      ACTUAL       VALUE  RESIDUAL    RESIDUAL  RESIDUAL     -2-1-0 1 2

  1  INDIA            3.600       4.503  -.902523    0.832355    -1.084    |     **|   |
  2  NIGERIA          3.800       3.939  -.138750    0.601736    -0.314    |       |   |
  3  KOREA            8.600       8.304  0.296421    0.436942     0.673    |       |*  |
  4  TURKEY           5.100       4.786  0.314426    0.810182     0.388    |       |   |
  5  YUGOSLV          5.500       4.390     1.110    0.798010     1.391    |       |** |
  6  SPAIN            3.100       3.907  -.807118    0.692042    -1.166    |     **|   |
  7  PARAGUA          8.500       9.672    -1.172    0.606079    -1.934    |    ***|   |
  8  VENEZUEL         4.100       4.919  -.818923    0.840076    -0.975    |      *|   |
  9  MEXICO           6.400       5.780  0.619775    0.813785     0.762    |       |*  |
 10  BRAZIL           7.600       6.342     1.258    0.674671     1.865    |       |***|
 11  ALGERIA          6.600       6.151  0.443755    0.703169     0.634    |       |*  |
 12  PHILIPP          6.000       5.751  0.249405    0.681748     0.366    |       |   |
 13  ECUADOR          8.100           .         .           .         .
 14  COLOMBIA         5.400       5.543  -.143203    0.805411    -0.178    |       |   |
 15  ARGENTIN         1.500       1.764  -.264054    0.679194    -0.389    |       |   |
 16  SAUDIAR          3.600           .         .           .         .
 17  SYRIA            8.300           .         .           .         .
 18  JORDAN           9.300           .         .           .         .
SUM OF RESIDUALS                 1.6431
SUM OF SQUARED RESIDUALS             7.
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IV. CONCLUSIONS

The purpose of this paper has been to examine the relationship between defense, health, and education expenditures and economic growth in developing countries. A model for economic growth was derived through the use of factor and regression analysis and the countries were divided into two groups through the use of discriminant analysis. Application of the economic growth model to these two groups of countries provided evidence that was used to support the hypothesis of this study. It was hypothesized that less economically dynamic countries would sacrifice social expenditures such as health and education in favor of military expenditures while the more economically dynamic countries would spend on defnese as well as social needs. The basis for this hypothesis was the reasoning that military spending had a positive effect on growth while social spending had the opposite effect.

The evidence obtained through the test of the economic growth model only partially supported the hypothesis. It was found that the relationship between economic growth and defense expenditures was positive and statistically significant for the less economically dynamic countries. This result was consistent with Benoit's findings. But the effect of social expenditures was not evident since the results were not statistically significant. This lack of evidence may have been due to data selection and availability. The addition of other variables such as welfare and housing into the social expenditures variable would have made a larger composite of data to compare with economic growth. But these variables had data that was available for a low number of observations. The test of the second model using only the two test variables showed that defense and social expenditures are positively related and statistically significant for the less economically dynamic countries. This suggested that the sacrifice of social monies for defense may not operate as hypothesized for this group.

Using the economic growth model test upon the more economically dynamic countries it was found that defense expenditures were negatively related to growth and statistically significant. This suggested that the military in these countries may perform strictly military functions while civilian sectors assume the functions of building the infrastructure and providing local security as suggested by Benoit. The second test on these countries using the test variable model showed that defense and social expenditures were negatively related and statistically significant. This suggested that there exists a trade-off between these expenditures in the more economically dynamic countries.

The uniqueness of the Latin American case was tested using the economic growth model, the test variable model, and a dummy variable. The use of the dummy variable was the only test of the three to provide useable results. The lack of statistical significance for the value of the dummy variable provided evidence to suggest that Latin America was not unique as a region when compared to the rest of the world's developing countries as expected.

While the findings of this study do not provide the evidence necessary to support every aspect of the hypothesis some insight has been gained regarding the relationship between defense and social expenditures and economic growth for developing countries. Since this was a cross-sectional study and only looked at one point in time it would be helpful to examine government expenditures over a period of time and make comparisons in order to contribute to the formulation of a general theory of defense expenditures and economic growth.

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